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R31FSm
Cap. 2.
Seasonal Snow Survey and Forecast of Stream Flow — April, 1947

Nevada Co-operative Snow Surveys

CENTRAL SIERRA QUADRANGLE

Including the Truckee, Tahoe, Carson and East and West Walker Basins of the Eastern Slope

CO-OPERATION

The organizations co-operating in the surveys of this region are: The Nevada Co-operative Snow Surveys, including the State of Nevada, through the State Engineer's office, the Truckee-Carson Irrigation District, the Washoe County Water Conservation District, the Walker River Irrigation District, and the Sierra Pacific Power Co.; the California Co-operative Snow Surveys headed by the Division of Water Resources of the Department of Public Works at Sacramento and including the Pacific Gas & Electric Co. and the Nevada Irrigation District, whose employees make the surveys of several of the courses used in this forecast; the U. S. Forest Service; and the Division of Irrigation of the U. S. Soil Conservation Service; the Nevada Agricultural Experiment Station at the University of Nevada. The Division of Irrigation is the organization which is developing and co-ordinating the snow surveys throughout the western states. All of the above organizations contribute financially to the work. The U. S. Weather Bureau also co-operates in various ways.

REVIEW OF LAST YEAR

There was a considerable deficiency of April-July precipitation in 1946 which must be the main reason for the low results in rise of Lake Tahoe and runoff of the Truckee River exclusive of Tahoe. However, the other rivers—the Carson, and both East and West Walker—checked very well in runoff with the probable forecast made in 1946. The maximum elevation date for Tahoe was forecast as July 15 but actually was reached June 24 and again same elevation on July 7.

§1946 RESULTS

BASIN OR STREAM	1946 Forecast			Actual Results	
	Normals Feet & Acre Feet	Amount Feet & Acre Feet	% of Normal	% of Normal	Amount Feet & Acre Feet
*Rise of Tahoe April 1 to Maximum.....	1.68 Feet	†1.50	89.3	70.8	1.19
*Maximum Elevation of Water Surface.....		6229.25			6228.94
All for April-July Runoff except East Walker	Acre Feet	Acre Feet			Acre Feet
Truckee River at Farad—Natural Flow Exclusive of Tahoe.....	325,700	†290,000	89.0	82.4	268,230
Carson River at Fort Churchill.....	230,000	150,000	65.2	66.7	153,500
West Walker River Below East Fork Junction.....	191,200	150,000	78.5	77.7	148,640
†East Walker River Natural Flow below Bridgeport Dam.....	73,000	65,000	89.0	82.3	60,100

*Assuming gates kept closed—no outflow.

†East Walker Runoff period is April-August because of late melting and runoff from high altitudes and northeast slopes of the Sawtooth Range west of Bridgeport. Runoff corrected for storage and evaporation in Bridgeport reservoir.

†Forecast used in above table for Tahoe and Truckee River is that given under the heading "Possible Minimum" in the published 1946 Forecast because of very deficient April-July precipitation on those basins.

§Normals and percentages in this Table are those in use through 1946.

OUTLOOK FOR 1947

The outlook for 1947 is poor. The precipitation was heavy in November, bringing considerable snow to the high altitudes, but the results throughout the rest of the winter were disappointing. At the present time, April 24th, there appears to be considerable probability of deficient spring and summer precipitation this year. The April precipitation through the 20th of the month at Tahoe City and Soda Springs was less than half of the normal due for April and we usually expect the precipitation to be heavier early in the month than later.

Should the April-July precipitation be very deficient the forecast given in the second part of the table on the last page, i. e., the part labeled "Precipitation Very Deficient," will probably come closer to what is actually realized than the first table planned for "Normal Precipitation."

As will be seen by the tabulation of April 1st snow survey results, the low level snow courses are very deficient in water equivalent—some of them being actually bare on April 1st. The high level courses are much better but still considerably below normal.

Due to the fact that storage in reservoirs is in pretty good shape this year the lands supplied from such reservoirs will probably have sufficient water for this season's irrigation. But valleys not supplied with upstream storage will be deficient in water supply.

NOTES REGARDING THE VARIOUS BASINS

In the Truckee basin the storage in Boca reservoir was 14,300 acre feet April 1st with a total capacity of 40,900 acre feet. This reservoir may be filled this season, as also will probably be Independence Lake.

Lake Tahoe was at elevation 6227.31 on April 1st and, due to the low figure estimated for rise from April 1 to maximum elevation and the fact that evaporation acts as usual, the lake will be lower next fall than it has been for several years. Should next year be another low one the following fall will find the lake close to the rim.

The water in the lake above the rim, elevation 6223.0, was approximately 530,000 acre feet on April 1. The total capacity from the rim to the maximum permitted elevation of 6229.1 is approximately 750,000 acre feet.

The Lahontan Reservoir on the Carson River, which is partly filled by water from the Truckee-Carson diversion canal, contained 245,560 acre feet on April 1, total capacity being about 286,000 acre feet.

Since the Carson River has no considerable storage reservoirs on the East or West forks there will be a considerable deficiency of water for irrigation in the Carson Valley and Dayton regions.

Both the East and the West Walker Reservoirs are in good shape, Topaz Reservoir on the West Walker containing 52,250 acre feet on April 1st with a capacity of 60,000 acre feet, and Bridgeport Reservoir on the East Walker being full on April 1 with a capacity of 42,500 acre feet.

REVISION OF SNOW COURSES

During the past year a number of our formerly long snow courses have been revised by decreasing the number of samples to be measured so that there will be not over 10 to 15 samples for most of them. In most cases the former courses contained 30 to 40 samples. This decrease is in the interest of accuracy and it is believed that the smaller number of samples give practically as reliable information for the region as the large number of samples.

CHANGE OF NORMALS

Most of the normals in use for streamflow and rise of Tahoe that have been in use for a number of years were determined in 1928, except for the East Walker which had but few years of measurement previous to that year. Since the streamflow records for the Truckee, the Carson and the West Walker Rivers, and also the Rise of Lake records for Tahoe, extended back near the beginning of this century they included a number of very heavy precipitation years in the early 1900's. The effect of this was that the normals determined in 1928 were probably too high.

The Forecast Committee concluded that it was time to revise these normals so that now they are based on a 45-year period 1900-01 through 1945. Since the Carson River and the West Walker records do not include all of these 45 years their normals are determined by a comparison of the years available with the corresponding years of the Truckee River. In the cases of the Truckee, the Carson and the West Walker Rivers and the rise of Lake Tahoe from April 1 to maximum the new normals are considerably lower than the former normals, the changes being as follows:

Truckee River . . . new normal 290,000 acre feet; old normal 325,700.
 Carson River . . . new normal 200,000 acre feet; old normal 230,000.
 West Walker . . . new normal 175,000 acre feet; old normal 191,200.

Since the former normal for the East Walker did not include the early part of the century's heavy years its normal is not so much affected and there is a slight increase in the change from old normal 73,000 acre feet to new normal 75,000 acre feet, this being for the April-August period, whereas the other rivers are forecast for the April-July period. The rise of Tahoe normal has been changed from the old 1.68 to the new normal 1.55.

The reason for the decrease in most of these normals is that there were a number of very low years in the late 1920's and in the early 1930's that were not included in determining the old normals.

As to the snow survey water equivalent normals most of these are also changed and the method of determining the new snow survey normals was as follows:

For each snow course a graph relationship was developed between the snow survey water equivalent and the streamflow or rise of Tahoe. On this graph each year of record was represented by a dot. A straight line is determined on this graph which is based on certain years which seem to be consistent in relationship. Years that plot some distance from this line are frequently due to the fact that in that year the precipitation for the runoff period or for the previous fall was abnormally high or abnormally low. On this graph line the point which corresponds to the 100% or normal streamflow is assumed to determine the normal water equivalent for that snow course.

It is hoped that these relationship lines for each snow course and the new normals thus determined will help improve the accuracy of future forecasts.

1947

SPROGRESS SNOW SURVEYS DURING THE WINTER

Basin	Snow Course	Altitude of Snow Course	1947 Date of Snow Survey	Depth of Snow Inches	Density % Water	Water Equivalent Inches	April 1 Normal Water Equivalent		1947 % of April 1 Normal	Year 1946 % of April 1 Normal		Date
							New	Old				
South Yuba and Crest	Furnace Flat	6600	2/5 2/26	56.1 49.6	31.6 41.3	17.7 20.5	52.6 52.6	(59) (59)	33.6 39.0	68.6 93.9	1/30 3/5	
	Fordyce Lake	6500	2/4 2/25	48.7 37.6	30.4 42.0	14.8 15.8	45.3 45.3	(51) (51)	32.6 34.8	81.2 85.4	1/29 3/4	
	Soda Springs	6750	2/3 2/28	46.1 35.7	31.2 40.1	14.4 14.3	41.1 41.1	(42) (42)	35.0 34.8	77.6 88.8	2/1 3/1	
	Donner Summit	6900	2/3 2/28	51.9 46.9	30.6 38.2	15.9 17.9	44.6 44.6	47.8 47.8	35.6 40.1	74.2 91.9	2/1 3/1	
	Donner Lake	5950	2/4 2/27	24.0 15.7	28.8 44.6	6.9 7.0				18.9 in. 21.6 in.	1/31 3/1	
Truckee	Truckee Ranger Station	6000	2/4 3/5	18.8 21.6	25.0 27.3	4.7 5.9				11.6 in. 13.9 in.	1/31 3/2	
	Independence Lake	8400	3/1	59.6	40.1	23.9	49.3	(47)	48.5			
	Independence Camp	7000	2/28	29.0	36.6	10.6	(24.5)	(26.5)	43.3	102.9	3/3	
	Independence Creek	6300	2/28	10.7	40.2	4.3	(16)	18	26.9			
	Sage Hen Creek	6500	3/2	25.4	38.2	9.7	20.9	22	46.4	90.0	3/2	
	*Tahoe City	6250	2/1 3/1	14.9 Patchy	22.8 Ice	3.4	17.0 17.0	15.9 15.9	20.0	70.6 84.4	1/31 2/28	
Tahoe	Echo Summit	7500	2/3 2/28	70.1 63.0	30.0 35.7	21.0 22.5	(39) (39)	42.5	53.8 57.7	90.5 107.7	2/1 2/28	
	*Marlette Lake	8000	3/3	58.1	35.1	20.4	26.3	27.8	77.6	98.9	3/3	
	*Tahoe City	6250	2/1 3/1	14.9 Patchy	22.8 Ice	3.4	14.8	15.9	23.0	81.1 97.3	1/31 2/28	
	*Daggetts Pass	7350	3/1	31.6	35.4	11.2	14.3	16.3	78.3	100.0	3/9	
	Richardson No. 2	6500	3/1	28.5	29.1	8.3				15.2 in.	3/10	
Carson	Blue Lakes	8000	1/31 2/28	69.7 65.3	29.4 35.5	20.5 23.2	48.4 48.4	48.1	42.4 47.9	57.4 66.7	1/31 3/1	
	Carson Pass	8600	1/31 2/28	66.7 66.9	31.5 37.1	21.0 24.8	46.7 46.7	(48) (48)	45.0 53.1	51.2 61.1	1/21 2/22	
Mono	Tioga	9900	2/26	43.7	35.7	15.6		31	50.3	74.2	3/2	

§Percentages of normal for 1947 and also for 1946 in this table are all based on new normals wherever available, and revised courses where revisions have been made.

§§Decreasing the number of samples to be measured of former course.

§APRIL 1, 1947 SNOW SURVEY DATA

Snow Survey Course	Elevation of Snow Course Feet	Date of 1947 Snow Survey	Depth of Snow Inches	Density of Snow % Water	Water Equiva- lent Inches	April 1 Normal Water Equivalent New Normal Inches	April 1 Normal Water Equivalent Old Normal Inches	1947 Seasonal % of Normal	Last Year (1946) % of Normal
TRUCKEE BASIN									
Crest and South Yuba									
Furnace Flat.....	6600	3/26	65.0	44.2	28.7	52.6	(59)	54.6	110.3
Fordyce Lake.....	6500	3/27	47.3	43.7	20.7	45.3	(51)	45.7	108.2
Soda Springs.....	6750	3/31	55.5	41.7	23.1	41.1	(42)	56.2	100.0
Donner Summit.....	6900	3/31	71.5	40.7	29.1	44.6	47.8	65.2	107.0
*Ward Creek.....	7000	4/3	99.8	37.9	37.8	53.0	52.7	71.3	102.5
Little Truckee									
Webber Peak.....	8000	3/31	86.7	39.4	34.2	47.8	56.9	71.5	95.8
Webber Lake.....	7000	3/31	67.3	37.6	25.3	39.9	38.1	63.4	99.5
Independence Lake.....	8400	3/30	85.3	37.2	31.7	49.3	(47)	64.3	99.4
Independence Camp.....	7000	3/29	31.3	40.6	12.7	24.5	(26.5)	51.8	120.8
Independence Creek.....	6300	3/29	9.9	47.5	4.7	(16)	18	29.4	100.0
Sage Hen Creek.....	6500	3/27	23.6	41.1	9.7	20.9	22	46.4	105.3
Eastern Outposts									
Granite Peak.....	8200	3/29	44.7	38.5	17.2		24.7	69.6	
*Big Meadow.....	8800	4/2	38.7	42.4	16.4	29.8	28.1	55.0	83.6
*Mount Rose (Contact Pass).....	9000	4/1	69.9	41.3	28.9	41.0	(45)	70.5	85.4
Lower Levels									
Boca No. 2.....	5900	3/27	Course Bare				(9)		
Truckee No. 2.....	6400	3/27	17.3	39.3	6.8	18.0	(20)	37.8	106.7
Donner Lake.....	5950	3/27	19.9	44.2	8.8				
Truckee Ranger Station.....	6000	4/1	Course Bare						
*Tahoe City.....	6250	4/1	Course Bare			17.0	15.9	Bare	86.5
TAHOE BASIN									
Crest—Main Sierra									
*Ward Creek.....	7000	4/3	99.8	37.9	37.8	52.7	51.2	71.7	103.0
*Rubicon Peak No. 1.....	8100	3/29	114.7	36.4	41.8	49.1	48.9	85.1	100.2
Rubicon Peak No. 2.....	7500	3/29	60.8	42.6	25.9	35.2	(36)	73.6	108.8
*Lake Lucile.....	8400	3/29	119.6	41.2	49.3	62.9	61.2	78.4	105.2
Echo Summit.....	7500	4/1	69.6	43.2	30.1	(39)	(42.5)	77.2	130.5
Eastern Outposts									
*Mount Rose.....	9000	4/1	69.9	41.3	28.9	39.7	(45)	72.8	88.2
*Marlette Lake.....	8000	4/2	49.4	41.5	20.5	26.3	27.8	77.9	120.9
*Hagan's Meadow (Freel Peak).....	8000	3/31	36.4	37.4	13.6	20.8	21.2	65.4	77.4
Lower Levels									
*Tahoe City.....	6250	4/1	Course Bare			14.8	15.9	Bare	99.3
Rubicon Peak No. 3.....	6700	3/29	38.8	33.8	13.1	22.3	(30)	58.7	126.9
Richardson's No. 2.....	6500	3/30	22.1	32.6	7.2				18.1 in.
Upper Truckee.....	6400	3/31	1.5	40.0	0.6		(11)	5.3	16.4
Freel Bench.....	7300	3/31	10.7	43.0	4.6	13.2	(15)	34.8	42.4
*Daggetts Pass.....	7350	3/28	22.6	33.6	7.6	14.3	16.3	53.1	117.5
Glenbrook No. 2.....	6900	3/28	30.1	33.2	10.0		(20)	50.0	94.0
WASHOE VALLEY									
*Marlette Lake.....	8000	4/2	49.4	41.5	20.5	26.3	27.8	77.9	119.4
Little Valley.....	6300	3/31	1.2	25.0	0.3				
CARSON BASIN									
Crest—West Carson									
Carson Pass.....	8600	3/27	67.8	45.0	30.5	46.7	(48)	65.3	72.6
Blue Lakes.....	8000	4/1	75.3	40.0	30.1	48.4	48.1	62.2	83.9
East Carson									
Poison Flat.....	7900	4/1	26.3	35.7	9.4	(17)	(18)	55.3	87.1
WALKER BASIN									
West Walker									
*Center Mountain.....	9400	3/26	73.7	41.9	30.9	42.8	45.7	72.2	94.9z
*Sonora Pass.....	8800	3/31	50.2	35.7	17.9	31.4	(31)	57.0	87.9
*Leavitt Meadows.....	7200	3/31	2.4	58.3	1.4	(11)	(16)	12.7	34.6
*Willow Flat.....	8250	4/1	21.0	37.6	7.9	12.5	(16)	63.2	96.0
East Walker									
*Center Mountain.....	9400	3/26	73.7	41.9	30.9	45.3	45.7	68.2	89.7z
*Buckeye Forks.....	8500	3/26	42.2	38.2	16.1	28.5	26.0	56.5	73.7
*Buckeye Roughs.....	7900	3/27	40.6	36.9	15.0	26.2	25.9	57.2	75.6
†Virginia Lakes.....	9500	3/28	37.7	42.2	15.9				
MONO BASIN									
Crest									
Tioga Pass.....	9900	3/26	51.4	37.7	19.4		31.0	62.6	103.5

§All percentages of normal in this table, both for 1947 and 1946, are based on new normals and revised courses where revisions have been made.

*Courses revised by decreasing number of samples to be measured of former course.

†New course.

()Signifies tentative, old or new.

zAdjusted value. Very inaccurate survey in 1946.

FORECAST — CENTRAL SIERRA — EASTERN SLOPE

APRIL-JULY, 1947

BASIN OR STREAM	New Normals	SEASONAL FORECAST With April-June Precipitation			
		Normal		Very Deficient	
		Amount	% of Normal	Amount	% of Normal
*Tahoe	Feet	Feet		Feet	
*Rise of Tahoe, April 1 to Maximum Elevation.....	1.55	0.85	54.8	0.65	41.9
*Maximum Elevation About June 15.....		6228.16		6227.96	
Truckee River at Farad (Natural Flow) Exclusive of Tahoe.....	Acre Feet	Acre Feet		Acre Feet	
	290,000	150,000	51.7	125,000	43.1
Carson River at Fort Churchill.....	200,000	100,000	50	80,000	40
West Walker near Coleville.....	175,000	105,000	60	90,000	51.4
†East Walker near Bridgeport Dam.....	75,000	40,000	53.3	30,000	40

*Assuming no outflow—gates kept closed. Tahoe was at elevation 6227.31 on April 1.

†The forecast period for the East Walker is April-August because of late melting of snow in high altitudes and on northeastern slopes of the Sawtooth Range west of Bridgeport.

Distribution of April-July Runoff in Typical Streams— Per Cent of Total April-July Runoff

	Truckee at Farad Excl. of Tahoe	Carson at Clifton	West Walker at Coleville
April	32	19	11
May	38	36	29
June	23	34	37
July	7	11	23
April-July	100.0	100.0	100.0

A retardation in the earlier months of the series assures an increase in the later months and vice versa.

Table A, below, shows what Lake Tahoe is able to supply at various elevations with gates wide open. Table B, below, shows the need of drawing from the lake or other storage during the summer and fall to maintain a flow of 500 cubic feet per second at Farad.

A. Draft Possible at Various Elevations:

Elev. (Ft.)	Draft (C.F.S.)	Elev. (Ft.)	Draft (C.F.S.)
6223.0	0	6225.5	520
6223.5	23	6226.0	730
6224.0	88	6227.0	1160
6224.5	183	6228.0	1600
6225.0	325	6229.0	2060

One foot depth on Tahoe is equivalent to 123,000 Acre Feet.

B. Natural Flow of Truckee River at Farad, Exclusive of Tahoe (Much Affected by Rains) August-October:

	Normal Acre Feet	Second Feet
August	7485	122
September	5800	97
October	6545	106

WINTER PRECIPITATION

*Typical Progress through Winter for
Central Sierra Region:

Dec.-March		Nov.-March	
Date	% Due	Date	% Due
Dec. 1	0	Dec. 1	12
Jan. 1	21	Jan. 1	31
Feb. 1	50	Feb. 1	57
Mar. 1	76	Mar. 1	79
Apr. 1	100	Apr. 1	100

†Seasonal Progress

Tahoe City, Nov.-March 1946-47

Date	% of Seasonal	This Season		Normal Due Inches
		Actual Inches	% of Normal Due	
Dec. 1	42	8.44	281	3.0
Jan. 1	53	10.72	139	7.7
Feb. 1	62	12.52	89	14.1
Mar. 1	75	15.29	78	19.6
Apr. 1	100	20.31	82	24.81

*Based on U. S. W. B. Revised Normals, %
Due being averages for nine U. S. W. B.
Stations in Central Sierra.

†Percent of Normal Due based on U. S. W. B.
Revised Normals for Tahoe City.

Nov.-March Normal24.81

Dec.-March Normal21.89

Reno, Nevada, April 24, 1947.

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